Model Based Aircraft Upset Detection and Recovery System, Phase I

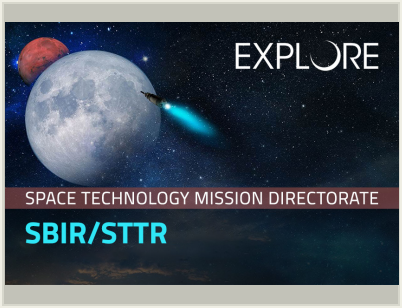
Completed Technology Project (2007 - 2007)

Project Introduction

This proposal describes a system for detecting upset conditions and providing the corresponding control recovery actions to maintain flight integrity for general application to aircraft. To maintain and improve aircraft safety as air capacity grows as part of the Next Generation Air Transportation System (NGATS), it is necessary to address the primary causes leading to in-flight loss of control accidents, including aircraft upsets, degraded flight operations, and environmental disturbance effects. A model-based upset detection and recovery control architecture is proposed that combines fault detection algorithms to identify the onset of an upset condition with optimal and near-optimal control responses. On-line parameter identification algorithms are used to adapt the core detection and recovery algorithms for degraded flight operations and/or modeling uncertainties. Distributed MEMS-based sensing and SMA-driven control effectors are used to augment the installed aircraft state measurements and control capability for rapid detection of and recovery from upset conditions. During Phase I, preliminary system design and application to a small unmanned aircraft will be performed, including flight test demonstration of the upset detection and control algorithms and hardware. This work will form the foundation for subsequent development of a family of aircraft upset mitigation systems for both manned and unmanned aircraft.

Anticipated Benefits

Potential NASA Commercial Applications: In addition to improving safety of existing and future manned aircraft, the results of this research and development will also benefit unmanned aviation. Detection and mitigation of upset conditions for unmanned air vehicles (UAVs) will directly impact military operations in which UAV accident rates are one to two orders of magnitude greater than for manned aircraft. Furthermore, by decreasing the susceptibility of UAVs to upset-induced losses through increased autonomy, a significant hurdle impeding public acceptance of UAV operations in the civil airspace will be overcome, opening the door for commercial and civil applications of unmanned aircraft systems.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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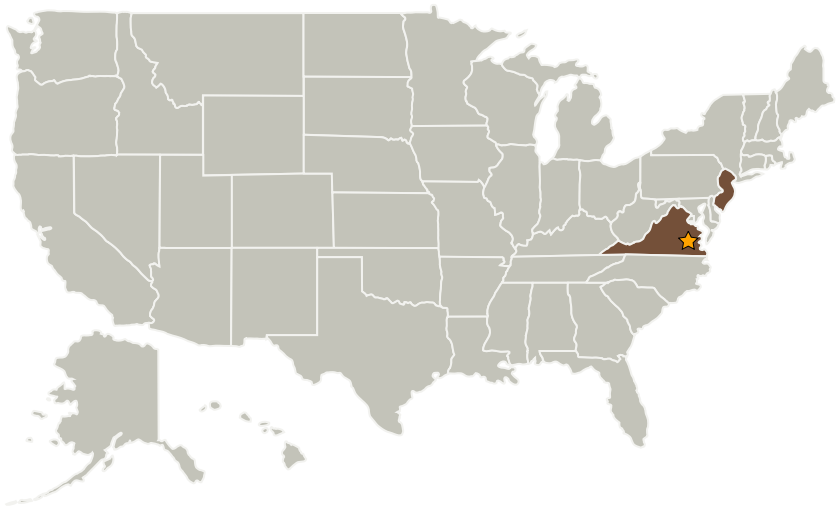
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Continuum Dynamics, Inc.	Supporting Organization	Industry	Ewing, New Jersey

Primary U.S. Work Locations	
New Jersey	Virginia

Project Transitions

January 2007: Project Start

July 2007: Closed out

Closeout Summary: Model Based Aircraft Upset Detection and Recovery System, Phase I Project Image

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jefrfrey D Keller

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.6 Fault Response